Previous Year Solved Question Paper

of

G.A.T.E. (XL) 2006

LIFE SCIENCES

XL: Chemistry

Examination

(Original Question Paper with Answer Key)

**GRADUATE APTITUDE TEST IN ENGINEERING**

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H: Chemistry (Compulsory)

Q. 1 – Q. 6 carry one mark each.

Q.1 Which one of the following is not a state function?

(A) Enthalpy (H)   (B) Internal energy (U)   (C) Work done (w)   (D) Entropy (S)

Q.2 Specify which among the following statements describe uncertainty principle

(A) No two electrons in an atom can have the same set of four quantum numbers
(B) It is impossible to determine simultaneously the velocity and momentum of an object with certainty
(C) Matter like radiation exhibit a dual behavior
(D) It is impossible to simultaneously determine the position and momentum of an object with certainty

Q.3 Among the given compounds, the most stable halogen containing compound of sulfur is

(A) SF_6 (B) S_2Cl_2 (C) SF_4 (D) $SOCl_2$

Q.4 The nucleophile among the following is

(A) BF_3 (B) SO_3 (C) $(CH_3)_3 N$ (D) NO_2^+

Q.5 In the reaction

$$A+B \rightarrow Products,$$
If the concentration of A is doubled, the rate of the reaction increases by a factor of 4. However, if the concentration of B is doubled, the rate remains unaltered. The order of the reaction with respect to A and B will be respectively

(A) 2 and 1   (B) 2 and 0   (C) 1 and 0   (D) 1 and 1

Q.6 The major product (X) of the reaction

$$BrCH_2\text{-}CH_2\text{-}CH_2Br \xrightarrow{\text{Zinc dust}} (X)$$
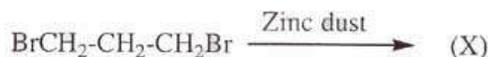
is
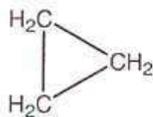
(A)   (B) $CH_2 = CH\text{-} CH_2 Br$

(C) $BrCH_2\text{-} CH = CH_2$ (D) $CH_2 = C =CH_2$

Q. 7 - Q. 24 carry two marks each.

Q.7   Which among the following steps is NOT present in the determination of lattice enthalpy of NaI using the Born- Haber cycle

(A) $\frac{1}{2} I_2(s) \longrightarrow \frac{1}{2} I_2(g)$
(B) $Na(s) \longrightarrow Na(l)$
(C) $\frac{1}{2} I_2(g) \longrightarrow I(g)$
(D) $I(g) + e- \longrightarrow I^-(g)$

Q.8   The boiling point of pure benzene is 80.0 °C. When a certain amount of benzoic acid was added to it, the boiling point increased to 82.5 °C. If the ebullioscopic constant (K_b) is 2.5 K kg mol^{-1}, the molality of the solution will be

(A) 0.02   (B) 0.25   (C) 1.00   (D) 6.25

Q.9   The structure of XeO_2F_2 based on VSEPR theory is best described as

(A) See-saw structure with the O-Xe-O angle close to 120°
(B) See-saw structure with F-Xe-F angle close to 120°
(C) A perfect tetrahedral arrangement of substituents around Xe
(D) A square planar structure with the fluorines trans to each other

Q.10   The hydrolysis of which of the following compounds would yield phosphorous acid (H_3PO_3)?

(A) PCl_5
(B) $POCl_3$
(C) P_4O_{10}
(D) PCl_3

Q.11   The type of hybridization that chromium show in $Cr(CO)_6$ and $[CrF_6]^{3-}$ are respectively [atomic number of chromium is 24]

(A) sp^3d^2 and d^2sp^3
(B) sp^3d^2 and sp^3d^2
(C) d^2sp^3 and d^2sp^3
(D) d^2sp^3 and sp^3d^2

Q.12   Which among the following molecules has the lowest bond dissociation energy?

(A) NO   (B) NO$^+$ (C) NO$^-$ (D) N$_2$

Q.13   A transition metal ion in its +3 oxidation state forms complexes with excess of F$^-$ as well as Cl$^-$. Given that the ionic radii of the metal ion, F$^-$ and Cl$^-$ are 0.64, 1.34 and 1.81 Å respectively, the geometries of the metal complexes formed will be

(A) $[MF_6]^{3-}$, octahedral   AND $[MCl_4]^-$, tetrahedral
(B) $[MF_6]^{3-}$, octahedral   AND $[MCl_6]^{3-}$, octahedral
(C) $[MF_4]^-$, tetrahedral   AND $[MCl_4]^-$, tetrahedral
(D) $[MF_4]^-$, tetrahedral   AND $[MCl_6]^{3-}$, octahedral

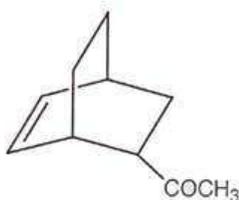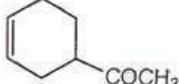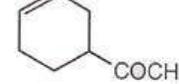Q.14 The reagent required for the conversion

$H_3C-C\equiv C-CH_3$ ⟶

(Cis)

are

(A) Na in liquid ammonia
(B) LiAlH$_4$
(C) Sn/ HCl
(D) Pd/ BaSO$_4$/ Quinoline

Q.15 For the synthesis of

using Diel's -Alder reaction, the reactants required are

(A)

 and

(B)

 and

(C)

 and

(D)

 and

Q.16 Match the values of K$_a$ (given in column 2) with the substituted benzoic acids (given in column 1)

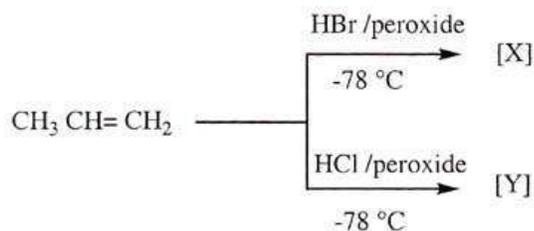Column 1   Column 2

[P] p – NO$_2$ [X] 36×10^{-5}
[Q] p – OH   [Y] 10×10^{-5}
[R] p – Cl   [Z] 2.6×10^{-5}

(A) P – X ; Q – Y ; R – Z
(B) P – Y ; Q – X ; R – Z
(C) P – Z ; Q – Y ; R – X
(D) P – X ; Q – Z ; R – Y

Q.17 The major products (X) and (Y) of the reactions

CH₃ CH= CH₂

HBr /peroxide
─────────────→ [X]
-78 °C

HCl /peroxide
─────────────→ [Y]
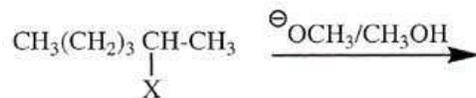-78 °C

are

(A) X = CH₃CHBrCH₃ ;   Y = CH₃CHClCH₃
(B) X = CH₃CH₂CH₂Br ;   Y = CH₃CHClCH₃
(C) X = CH₃CH₂CH₂Br ;   Y = CH₃CH₂CH₂Cl
(D) X = CH₃CHBrCH₃ ;   Y = CH₃CH₂CH₂Cl

Q.18 Nitration of p-nitrobiphenyl is carried out. The new nitro group would introduce at position/s-

O₂N-⬡-⬡ ← T

P Q   R S
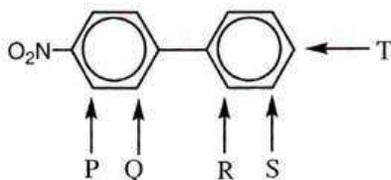
(A)   P and T   (B)   only Q
(C)   R and T   (D)   Q and S

Q.19 In the reaction

CH₃(CH₂)₃ CH-CH₃   ─⊖OCH₃/CH₃OH─→
           |
           X

If X = F in the first case and X = Br in the second case, the major product formed will be respectively

(A)   1- Hexene and   1- Hexene
(B)   1- Hexene and   2 - Hexene
(C)   2- Hexene and   2- Hexene
(D)   2- Hexene and   1- Hexene

Q.20   Henderson's equation can be represented as

(A) $pH = pK_a + \log\dfrac{[Acid]}{[Salt]}$

(B) $pH = pK_a + \log\dfrac{[Salt]}{[Acid]}$

(C) $pK_a = pH + \log\dfrac{[Salt]}{[Acid]}$

(D) $pK_a = pH - \log\dfrac{[Salt]}{[Acid]}$

Q.21   A concentrated solution of NaCl is diluted ten times. The specific conductance (κ) and molar conductance (Λ_m) will show the following behavior

(A) decrease in κ and increase in Λ_m

(B) increase in κ and decrease in Λ_m

(C) no change in both

(D) increase in both

Q.22   In the reaction

$$2SO_3(g) \rightleftharpoons 2SO_2(g) + O_2(g)$$
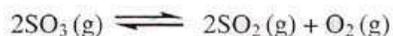
taking place at 27 ^{0}C, K_p is 3.0×10^{-23} atm. The value of K_c (in mol dm^{-3}) for the reaction is
[Given R = 0.0821 dm^3 atm K^{-1} mol^{-1}]

(A) 74×10^{-23}
(B) 12×10^{-25}
(C) 5×10^{-26}
(D) 2×10^{-27}

Common Data Questions

Common Data for Questions 23, 24:
KMnO$_4$ reacts with oxalic acid in the presence of excess H$_2$SO$_4$ to yield a manganese complex X which is colorless in dilute solutions and pale pink in the crystalline form [atomic number of manganese is 25].

Q.23   The number of unpaired electrons present in the complex X is

(A) 1   (B) 3   (C) 4   (D) 5

Q.24   The calculated spin only magnetic moment for the compound X is

(A) 5.92 BM   (B) 4.90 BM   (C) 3.87 BM   (D) 1.73 BM

Linked Answer Questions: Q. 25 to Q. 28 carry two marks each.
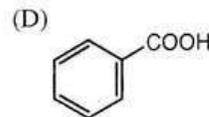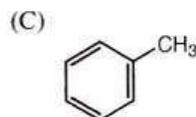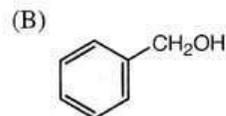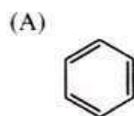
Statement for Linked Answer Questions 25 & 26:
Benzene reacts with 1-chloro-2-methylpropane in presence of anhydrous $AlCl_3$ at 20 °C to give major product (X).
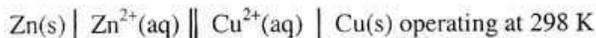
Q.25   The product (X) is

(A)
$CH_2CH(CH_3)_2$

(B)
$CH_2CH_2CH_2CH_3$

(C)
$C(CH_3)_3$

(D)
CH_2CH-CH_2Cl
       CH_3
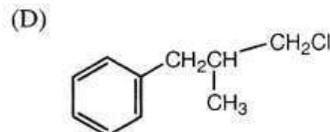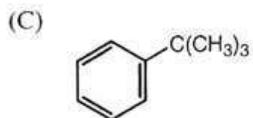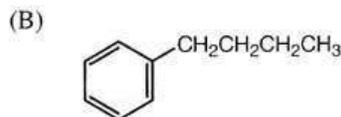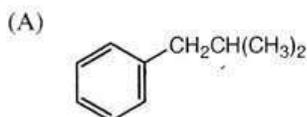
Q.26   Compound (X) on treatment with hot acidic $KMnO_4$ followed by reaction with $LiAlH_4$ gives (Y). Compound (Y) is

(A)

(B)
CH_2OH

(C)
CH_3

(D)
$COOH$

Statement for Linked Answer Questions 27 & 28:
Consider a cell :

$$Zn(s) \mid Zn^{2+}(aq) \parallel Cu^{2+}(aq) \mid Cu(s) \text{ operating at 298 K}$$

[Given $E^0(Zn^{2+}/Zn) = -0.763V$ and $E^0(Cu/Cu^{2+}) = -0.337V$]

Q.27   The emf of the cell (E^0_{cell}) will be

(A) 1.100 V   (B) 0.426 V   (C) –1.10 V   (D) – 0.426 V

Q.28   The value of log K for the cell reaction: $Zn (s) + Cu^{2+}(aq) \rightleftharpoons Zn^{2+}(aq) + Cu (s)$ where K is the equilibrium constant will be

[Given R = 8.314 JK^{-1} mol^{-1}, F = 96,500 C mol^{-1}]

(A) 18.61   (B) 14.41   (C) –14.41   (D) 37.22

END OF THE SECTION

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